LOOP INPUT METHODOLOGY

Loop Module Inputs

The information contained below defines the development of the CenturyLink Loop Module (LM) inputs that are used to determine investments related to outside plant, digital loop carrier, and high capacity loop SONET terminals. The inputs are discussed in the order in which they are found in the inputs to LM.

CenturyLink's company-specific inputs reflect the realities of providing local service in its operating territory. CenturyLink's recent experience with actual purchase, installation, and ongoing maintenance of telephone plant equipment provides the best information for predicting the forward-looking costs within CenturyLink's service territory. The material inputs are based upon current vendor prices for material and equipment, plus CenturyLink-specific labor costs for engineering, plant supervision, and installation. State-specific sales tax is also included in the material calculations.

Recent factual and objective data provides the best basis for predicting the forward-looking cost of constructing telephone plant in CenturyLink's service territory. Inputs developed in this fashion provide the most verifiable data possible for estimating the cost of rebuilding a network in that same market. After the inputs are developed, they are entered into the Loop Module.

The Loop Module inputs are developed from data in CenturyLink's network cost administration system, which CenturyLink uses to prepare capital budgets and create construction projects as well as bid all network contracts and projects for various types of construction/installation related work activities. These system data include the most recent three years of closed invoice-level detail for capital material dollars and units, labor dollars and units, and other minor material dollars and units, as well as applicable taxes. While the data are coded to provide study area specificity, I aggregated the data at regional levels that sometimes include multiple states. This eliminates problems in small study areas where some activity inputs or cable size inputs might not have been used in CenturyLink's actual network.

Data are grouped by capital account for poles, aerial metallic, aerial nonmetallic, buried metallic, buried nonmetallic, underground metallic, underground nonmetallic, and conduit. Material units are summarized by cable size such that total material dollars are divided by total feet placed to produce a cost per foot.

The Loop Module allocates labor related to cable based on plant account and split among engineering, placing, and splicing based on assembly unit codes. Assembly units are standardized by type of labor activity[1]. Labor units are summarized by cable size such that total labor dollars are divided by total units to

[1] http://www.rd.usda.gov/files/UTP_Bulletins_1753F-151.pdf

produce a cost per foot. Labor not specific to plant accounts are allocated based on the weighted frequency of cable size used. If 48-fiber cables are used more frequently than 60-fiber cables, labor expense will be applied according to the weighted frequency of the cable size. Splicing labor is added based on a percentage factor applied to the sum of total material per foot and total labor per foot.

Aerial cable and underground cable inputs include associated labor for cable placement. For aerial plant, the pole inputs include the cost of poles and labor for placement along with anchor and guy costs. Strand is also included. For underground plant, the cost of trenching, conduit, and manholes are also derived using the network cost administration data. Underground cable labor includes the cost of placing the cable in the conduit. However, for buried cable, only the cost of material and labor related to splicing and engineering are included. For buried cable, labor for placement is included as part of the costs related to trenching.

Trenching costs for buried and underground are derived using a similar *m*ethodology: data from the network cost administration system are pulled, grouped according to assembly units, and total dollars are divided by total units placed to derive a cost per foot for placing cable. Costs for various types of cable placement are calculated, and a weighted average total per foot is calculated by geographic area.

Once the Loop Module calculates cost per foot, I compared these results to prior studies for any anomalies to ensure only accurate data were used to develop the Loop Module inputs.

Plant Mix. Cable plant mix inputs are the percentages of aerial, underground and buried cable placements within each of the Loop Module's density groups. The model applies separate inputs for cable type (copper or fiber), usage (distribution or feeder), and terrain (normal, medium rock, or hard rock).

Plant mix is driven by many region-specific factors. Factors weighed in selecting the type of outside facilities include state/county/city code restrictions, market growth rates, maintenance cost considerations, potential service disruptions, and initial first cost considerations. These considerations apply to both feeder and distribution cables.

Maintenance cost considerations are evaluated for each type of cable facility before a cable type is selected. Acts of nature and acts caused by man become important considerations when evaluating potential maintenance costs. Aerial cables are subject to many types of damage including fallen trees or limbs, animals, high winds, automobile accidents and lightning. Underground or buried cables are subject to rapid deterioration in an area having a high water table.

The cost to build a job without consideration of future costs or benefits is defined as the “initial first cost.” Although this is an important consideration because it requires current outlays, initial first costs are only one consideration in determining which plant type is used in the model. Evaluation of the remaining considerations may indicate a low initial first cost but higher future maintenance costs. For example, the initial first cost of an aerial cable would be far less than an underground cable requiring the construction of a conduit. However, if facilities are being placed in a high growth area, underground facilities would probably be more conducive to continual reinforcement, potentially resulting in a lower total cost.

Plant mix varies by density within a wire center. Higher density urban areas contain more underground plant placed in conduit than suburban or rural areas. Generally, dense urban areas have little buried plant where cables are placed directly into a trench rather than in conduit structure, but do sometimes have aerial plant placed on poles. Suburban areas are a mix of buried, aerial, and underground, while rural areas are predominately a mix of buried and aerial plant. Each State presents a different mix of plant types that depend on the urban/rural mix, the climate and the soil/terrain.

The CenturyLink plant mix inputs for its 37-state service area were also used as an input in developing the CACM’s approved plant mix inputs by state. The source of the data for these plant mix calculations are CenturyLink’s outside plant records. Sheath miles by type and size of cable are extracted from the outside plant records by wire center for the service territory. To determine the plant mix inputs for each density zone, the density of each wire center is first calculated based on access lines per square mile and assigned one of the nine zones defined in the model. Second, sheath miles are calculated for the groups of wire centers falling into each density zone, by cable type (copper feeder, copper distribution, and fiber) total sheath miles and total plant specific sheath miles. Finally, plant specific sheath miles are divided by total sheath miles for each density zone, with the result being a percentage of plant type by zone.

Because outside plant records for a given study area may be insufficient to generate results at the density zone levels the model inputs require, CenturyLink applies linear regression to the available data to fill in density zone gaps. When data within a state are insufficient to perform a regression, regional results across multiple states within the same geographic area of the country may be used. When state level and regional level data are insufficient, national averages may be used. For the studies described, state specific plant mix inputs were used for all states.

Loop Cost Inputs

Drop

The drop connects the end user's Network Interface Device (NID) to the drop terminal.

Buried Drop

Buried drop costs are the costs of the drop that is buried from the pedestal (drop terminal) to the NID attached to the customer's premises. Inputs are the material cost per foot for the drop wire only.

Aerial Drop

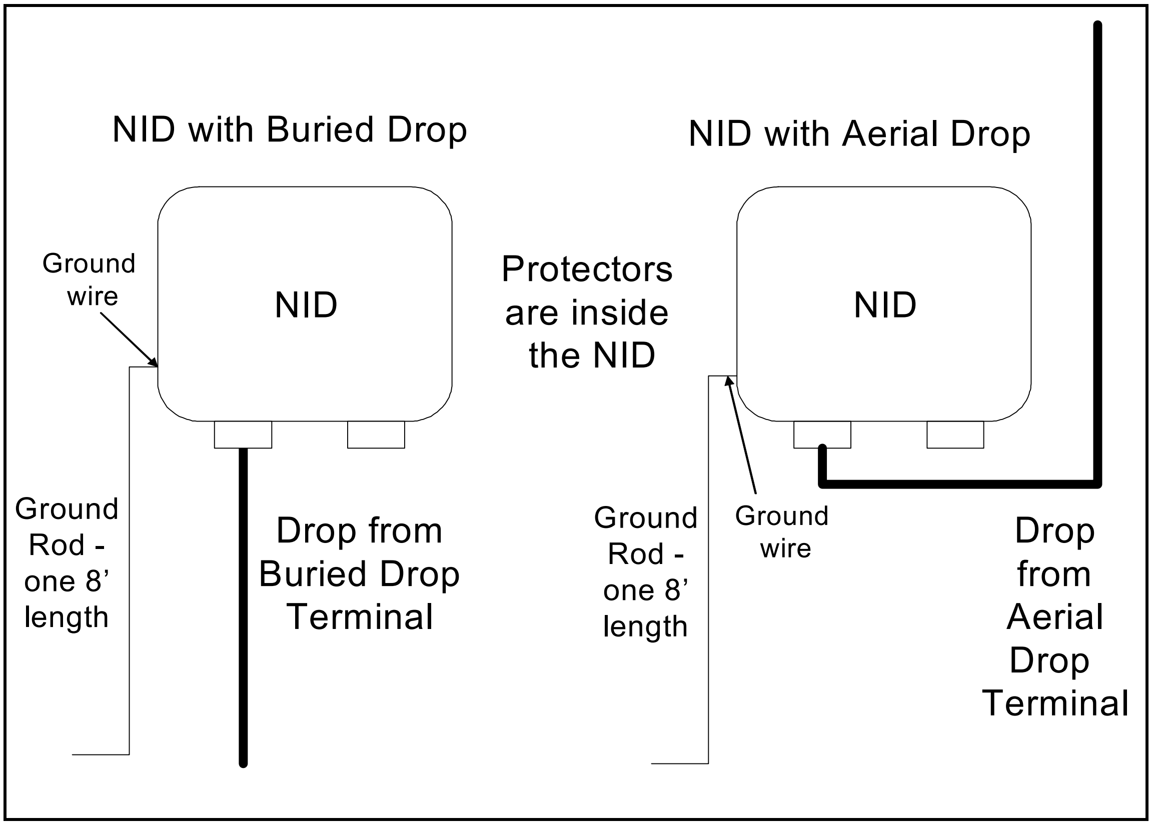
Aerial drop costs include the cost of the drop wire that is placed from the terminal, on or near a pole to the customer's location, terminating at the NID. Included in this cost are the attachment devices and the labor to install the drop. Inputs are the material cost per foot for the drop wire only.

Network Interface Device

The Network Interface Device (NID) is a device that is necessary for connecting a loop to an end user's premises. The NID is the point of demarcation between the local exchange carrier and the customer, and additionally serves to provide the customer with electrical surge protection. One NID houses up to six cable pairs, so its primary use is for residences or small businesses. A typical NID is pictured below.

Network Interface Device (NID)

Separate inputs for additional protectors may also be populated. The NID input includes a ground rod, ground wire and labor for installation. The components of the NID are shown following, with the drop added for clarity.


NID with Buried Drop
NID with Aerial Drop
Ground wire
NID
Protectors are inside the NID
NID
Ground Rod - one 8’ length
Drop from Buried Drop Terminal
Ground Rod - one 8’ length
Ground wire
Drop from Aerial Drop Terminal

Building Terminal

A building terminal has functionality comparable to that of the NID, only with greater capacity. Building terminals house cable pairs in 25 pair increments, up to 150 pair, and are primarily utilized for business locations or multi-tenant dwellings. Ground rods and ground wire are also included in the inputs. For quantities greater than 150 pair, an indoor Feeder Distribution Interface (FDI) is used. The inputs include the cost of material per building terminal unit and labor for installation.

Cable – Fiber and Copper

Overview of Cable Cost Development

Cable cost inputs are a function of material and labor. LM uses either all copper cable or a combination of copper and fiber cables to build the loop network. Cable refers to the copper or fiber media used to carry the call signal from the central office to the end user.

Cable material is compromised of cable itself along with small, non-reportable items such as gravel or other miscellaneous material not captured in other inputs, but still necessary to the construction process.

Cable labor is comprised of engineering, placing, and splicing. Each type of labor is determined by plant type based on work order data drawn from recent actual construction done in CenturyLink's serving areas. The recent labor required to build additional plant in CenturyLink's current network will reflect the labor required to build the network on a forward-looking basis. Splicing labor varies by cable size as described below.

Engineering accounts for the activities required to design the cable route and to ensure that all industry standard engineering specifications are met. Engineering is calculated on a per foot basis because engineers typically design by route, rather than by cable size increment. For example, along the route the engineer must work within rights of way, account for any obstacles, and ensure that the cable can be placed at the proper depth (for buried and underground) or at the proper clearance (for aerial cable).

Placement accounts for the cost of installing the cable on a pole line, in a trench or in a conduit. Placing is determined on a per foot basis because the entire cable sheath is placed at once. Placement is restricted to the placement of aerial cable onto the support strand or the rodding of the ducts and the pulling of underground cable into its duct, since buried cable placement cost is included with the structure costs (i.e., the cost of digging the trench). CenturyLink does not include placement in buried cable labor inputs to reflect the fact that buried cable is placed simultaneously with the creation of the buried structure (i.e., trench), thus, the cost of buried structure includes the cost of placing the cable.

Splicing refers to the joining of two or more cables by connecting each individual copper pair or fiber strand. Splicing labor increases as the pairs to be spliced increases and thus will increase by cable size.

Cable material is combined with engineering, placing and splicing labor along with taxes (material and/or labor as applicable) and freight to determine the total installed cost of cable per foot.

Cost Components – Aerial Cable

Aerial cable costs include the cost of the cable, splice closures, miscellaneous materials, such as lashing wire and mounting hardware, the cost to purchase and ship the cable, acceptance testing as needed, engineering, and the cost of procuring any permits. Splicing occurs at cable junctions, cable size changes, where side legs intersect, where the reel ends, or at cable closures. The cost of engineering includes route layout, obtaining permits, securing rights-of-way and joint use coordination. CenturyLink obtains this information from recent state-specific work orders.

Cost Components – Buried Cable

The cost of buried cable includes cable material, miscellaneous minor material such as connectors, splice closures and clamps, permits, right of ways, flagging or other safety personnel or materials as needed, engineering, splicing, and any equipment necessary to facilitate the placement of buried cable. As described above, any costs related to the actual buried cable placement is included in the structure inputs. The cost of engineering includes route layout, obtaining permits, securing rights-of-way and joint use coordination.

Cost Components – Underground Cable

The costs of underground cable include the cable material, miscellaneous minor materials, splicing, engineering, and placing. Splicing can occur at cable segment ends and junctions. Placement costs for underground cable include:

- work site make ready and safety
- equipment set up
- testing for poisonous gases in each manhole
- pumping and ventilating each manhole
- rodding and cleaning the duct
- pulling in the cable
- pick up and delivery of cable and materials to the work site
- procurement of any permits
- pressure testing of splice cases

The cost of placing underground cable is calculated on a per foot basis and generally does not vary in relation to cable size. Splicing is calculated on a per pair (or fiber) foot basis to capture the increasing cost of splicing as pair increments increase, as explained above. The cost of engineering includes route layout, obtaining permits, securing rights-of-way and joint use coordination with other utilities. The cost of these engineering activities is calculated on a per foot basis and does not vary by cable size.

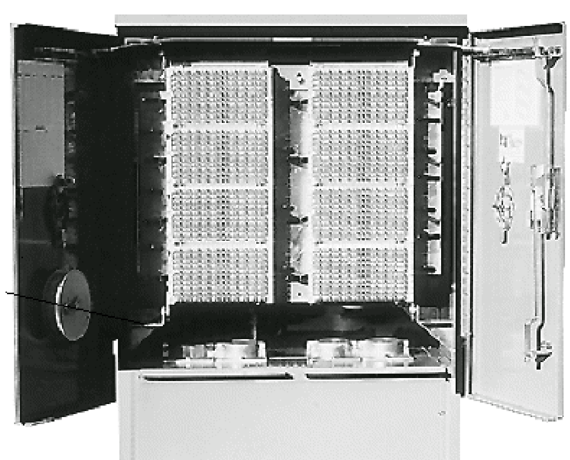
CenturyLink uses filled fiber cable for all fiber applications. Per foot costs are developed for standard size aerial, buried and underground fiber cables ranging from 12 to 288 fibers.

Feeder Distribution Interface

Feeder Distribution Interfaces (FDI) are used as the interfaces between feeder and distribution cables, and are also known as cross-connects. The FDI connects copper feeder and copper distribution and are used to increase the utilization of the pair count in the feeder. It may be located at the feeder/distribution connection point in an all copper loop, or between the copper feeder stub extending from a fiber-fed digital loop carrier (DLC) and the copper distribution cables. The FDI is the location where the jumper connections are made between the feeder and distribution cables. CenturyLink uses ready access cabinets for its FDIs, which give quick access to both the feeder and distribution cables terminations. Jumper wires are able to connect any feeder pair to any distribution pair, and jumpers are changed as necessary when service is requested. FDIs provide a reduction in cost when compared to direct cable splicing since maximum use can be made of all available feeder pairs without any re-splicing. The inputs to the model include all material necessary for an FDI, labor for installation, and engineering.

Outdoor Feeder Distribution Interface

The outdoor FDI is the interface between copper feeder cables and copper distribution cables. FDI sizes range from 25 to 7200 pairs, with the number representing total pairs in and out of the device. A typical pad-mounted outdoor FDI is shown below.



Outdoor Feeder Distribution Interface (FDI)

The material cost for outdoor FDIs includes the following components: a cabinet, template, punch down blocks, and frame as seen in the diagram above. The labor costs include workplace setup, protection time, the time to place the cabinet, terminate the feeder and distribution cables, and travel. The cost for a concrete mounting pad that is installed by an outside vendor is also included. State specific labor rates and tax rates are utilized in calculating the investment for FDI.

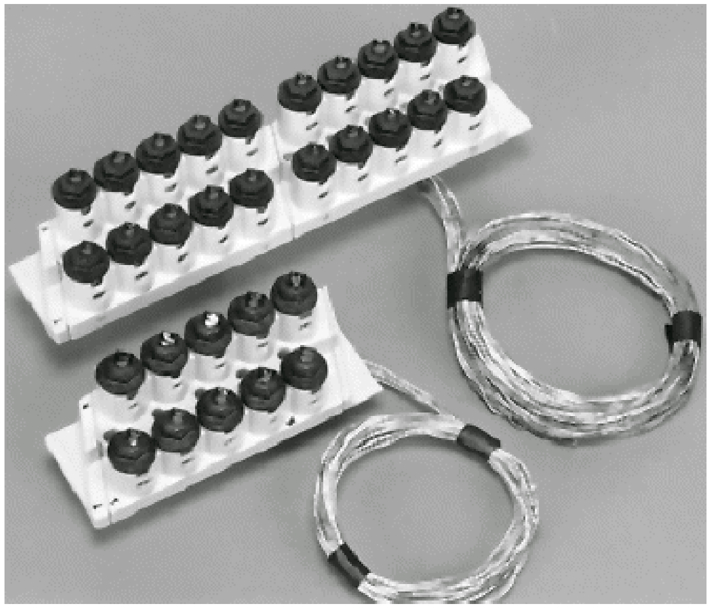
Indoor Feeder Distribution Interface
Indoor FDIs are placed in multi-tenant buildings and are sized for the number of lines terminated at that location. Indoor FDIs generally consists of terminal blocks fastened to a plywood board or metal frame located in the basement or wire closet of a building. Since the indoor FDI is a cable entrance point into a building, electrical surge protection is included in the indoor FDI design and cost.

Material costs include terminals (or Distribution Frames for very large pair sizes) with 40-foot tip cables, wall-mounted brackets, 5-pin protection modules, splice cases, tie cables, and punch down blocks. The labor includes splicing and installation of the terminals and travel time. CenturyLink-specific labor rates and tax rates are utilized.

Aerial Drop Terminal
Aerial drop terminals, shown below, provide the point of interconnection between the cable pair in an aerial distribution cable and an aerial drop wire. The terminal mounts on the cable suspension strand near the pole, or on the pole, and consists of a weatherproof cover that contains binding posts, which are spliced via a stub cable to the distribution cable. The aerial drop wire connects to one set of binding posts on a terminal block within the terminal.

Terminal costs in the model reflect ready access enclosures that will accommodate up to 48 pair terminal blocks. Terminals placed by the model are sized according to the number of connecting drops, and will contain terminal blocks in 6 pair increments, from 6 to 48 pair.

The installed cost of the aerial drop terminal includes the splice closure, terminal blocks, and labor for installation and splicing.



Aerial Drop Terminal

Buried Drop Terminal

Buried drop terminals, shown below, provide the point of interconnection between the cable pair in a buried or underground distribution cable and a buried drop wire. Terminal blocks are placed in an airtight and watertight, re-enterable enclosure constructed of high impact, thermoplastic material in which the distribution cable is accessible. Similar to aerial drop terminals, terminal blocks in the buried drop terminal are spliced to the buried or underground distribution cable via a stub cable. Buried drop wires are then connected to one set of the binding posts on the terminal block.

Terminal costs in the model reflect accessible enclosures that will accommodate up to 48 pair terminal blocks. Terminal blocks placed by the model are sized based on the number of connecting drops and will be in 6 pair increments, from 6 to 48 pairs.

The installed cost of the buried drop terminal includes the closure, terminal blocks, and labor for installation and splicing.

Buried Drop Terminal

Strand
Strand is the wire used to support the aerial cable; the cable is lashed to the strand. The strand is necessary for the support of aerial cable and attachments such as strand-mounted terminals. The cost of the strand investment includes the material cost.

Structure Inputs

Structure Inputs Overview

Structure costs are those costs related to the construction supporting the copper and fiber cables comprising the telephone loop and transport network. These structures are the poles and anchors/guys for aerial plant, the conduit and manhole systems for underground plant, and the trenching or other placement cost for buried plant. Structure costs for aerial and underground plant include the labor per foot required for placement of the structure as well as the related materials (e.g., poles, anchors/guys, conduit, and manholes), while structure costs for buried plant include the labor necessary to create the opening in the ground and restore the earth. These costs vary with surface terrain characteristics (e.g. soil vs. rock).

Underground Structure (Feeder/Distribution Conduit)
The cost of underground structure includes the costs for opening and closing any ground or surface necessary to place the conduit and manhole system. This may include cutting and restoring asphalt or concrete streets and sidewalks. The material and installation costs of the conduit and the manholes and/or handholes are also determined. Costs specific to manholes and conduit are further delineated in the Manhole Inputs. Underground structure inputs represent the costs per foot to perform the activities necessary to build the structure in which the conduit system is placed.

Buried Structure
The cost of buried structure consists of the costs for opening and closing the ground, including any surface restoration required. The inputs represent the cost per foot of the activities necessary to open, close, and restore the trench where the cable is placed.

Aerial Structure
Aerial structure costs consist of the material and installation cost of poles and the associated anchors and guys. They are converted to a per-pole cost based on the frequency of anchors and guys input (expressed in terms of the number of poles between each placement of an anchor and guy).

The cost of the poles is calculated by summing the loaded material and installation costs per pole and applying the percent assigned to telephone fraction to recognize that other entities (power, CATV) share the cost of the pole structure.

Typically, the percent of pole costs assigned to telephone was calculated based on the number of poles owned by CenturyLink versus the number of poles owned by other entities on which CenturyLink has attachments. When commission approved structure sharing percentages are available, they are used as input to the LM.

The pole, anchor, and guy material costs are the current prices CenturyLink pays for those materials. Sales tax is calculated using the appropriate state tax rate. Installation costs are based on actual contract costs for the total activities comprising pole, anchor, and guy placement. In addition, engineering costs are applied based on averages experienced during recently completed projects.

Pole spacing inputs range with the closer spacing occurring in more densely populated areas because of street clearance requirements and support requirements for larger cables. Anchor and guy spacing inputs range by density zone primarily due to right-of-way curvature or changes in elevation. Anchors and guys are placed only where horizontal or vertical direction changes occur or a pole line ends. Similar to poles, the spacing is closer in more dense areas because of the greater number of pole line terminations necessary in urban areas. The spacing inputs are based on company experience in placing aerial plant.

Manhole Inputs
The cost of manholes consists of the loaded material and installation cost of appropriately sized manholes and/or handholes. The manholes are sized based on the required number of ducts in the conduit system. Manholes and handholes are spaced at user-defined distances. Manhole and handhole spacing is based upon the average distance between access points (manholes and handholes).

This is calculated by dividing total actual trench feet by the total number of actual access points (manholes and handholes). The manhole inputs account for the manhole material and labor to engineer and install the manhole.

The cost of conduit consists of the loaded material cost of one foot of 4" PVC conduit. The cost of installing the PVC pipe is included in the structure costs discussed in Underground Structure.

Spacing Inputs

The Feeder and Distribution Spacing Tables reflect the incremental spacing of structure support facilities (e.g. manholes, poles) in accordance with population density zones.

Loop Percent Tables

Plant Mix Tables

Cable plant mix inputs are the percentages of aerial, underground and buried cable placements within each of the density groups. Separate inputs can be developed for cable type (copper or fiber), usage (distribution or feeder), and terrain (normal, medium rock, or hard rock).

Plant mix is driven by many region-specific factors. Factors weighed in selecting the type of outside facilities include state/county/city code restrictions, market growth rates, maintenance cost considerations, potential service disruptions, and initial first cost considerations. These considerations apply to both feeder and distribution cables.

Maintenance cost considerations are evaluated for each type of cable facility before a cable type is selected. Acts of nature and acts caused by man become important considerations when evaluating potential maintenance costs. Aerial cables are subjected to many types of damage including fallen trees or limbs, animals, high winds, automobile accidents and lightning. Underground or buried cables are subject to rapid deterioration in an area having a high water table.

Service disruptions differ from maintenance considerations. In the case of buried cable or underground cable, a common example would be a cable cut by digging or trenching by a contractor without having existing cable locations identified. This damage usually results in a temporary loss of service for customers served by the cable.

The cost to build the job without considering the future costs or benefits is defined as the initial first cost. Although this is an important consideration because it involves current outlays, initial first costs are only one consideration. The evaluation of the remaining considerations may indicate a low initial first cost but higher future maintenance costs. For example, the initial first cost of an aerial cable would be far less expensive compared to an underground cable requiring the construction of a conduit. However, if facilities were placed in a high growth area, underground facilities would probably be more conducive to continual reinforcement.

The source of data for plant mix calculations are CenturyLink's outside plant records. Sheath miles by type and size of cable are extracted from the records by wire center for the service territory. To determine the plant mix inputs for each density zone, the density of each wire center is first calculated based on access lines per square mile and assigned one of the nine zones defined in the model. Second, by cable type (copper feeder, copper distribution, and fiber) total sheath miles and total plant specific sheath miles are calculated for the groups of wire centers falling into each density zone. Finally, plant specific sheath miles are divided by total sheath miles for each density zone, with the result being a percentage of plant type by zone. The sheath miles for aerial, buried and underground cable are then summarized by density zone.

Because outside plant records for a given study area may be insufficient for generating results at the density zone levels the model inputs require, CenturyLink applies linear regression to the available data to fill in density zone gaps. When data within a state are insufficient to perform a regression, regional results across multiple states within the same geographic area of the country may be used. When state level and regional level data are insufficient, national averages may be used.

Density Cable Sizing Factor Table

Cable sizing factors reflect the percentage of available network capacity utilized by feeder and distribution cables. Proper cable sizing allows uninterrupted provision of new service and maintenance between cable additions. This means that cables are sized larger than initially needed so as to efficiently fill service requests until the next cable addition.

Care must be used in selecting cable capacity to avoid under sizing, which results in costly re-work, or over sizing, which results in capacity not being used. There are additional factors to consider in cable sizing. One is the lag time required to engineer and construct a new cable. Cable additions are added far enough in advance of cable pair exhaustion to enable the continued provision of new service.

Another factor to consider is the standard pair sizes of cables. Cables are available in a wide range of pair complements; cables of larger pair sizes increase by 300 pair increments (600, 900, 1200, and 1500). This means that if the forecasted demand for a new cable called for 950 pairs, a 1200 pair cable would be placed. This limitation caused by standard cable sizes will increase unused capacity.

Cable sizing factors are developed separately for feeder, distribution and fiber cables.

Distribution cables are sized to allow for pairs per housing unit (see Miscellaneous Inputs, Cable and Wire Inputs).

Structure Allocation Table

Structure allocation reflects the amount of the shared route structure allocated to copper cable facilities and fiber facilities, based upon cable size. For example, if a route is shared by both a copper and fiber facility, the fiber and copper would each be allocated a percentage of the structure cost.

Miscellaneous Inputs

This tab contains a series of individual input values for key assumptions such as cable placement depth, electronic fill, and maximum system and cable sizes.

Normal Underground/Buried Cover (Copper)

This input represents the depth at which copper cable is to be buried. CenturyLink uses a placement depth of 30 inches. The table indicates that copper feeder and distribution cables should be covered by a minimum of 30 inches of ground.

Normal Fiber Cover

This input represents the depth at which fiber cable is to be buried. The placement depth choice is confirmed in the engineering guidelines set by AT&T on the table labeled *Recommended Depths for Placing PIC Cable*[2].

Pairs Per Residential Unit

This input is used in the calculation to determine distribution cable sizes. CenturyLink uses current engineering guideline standards to build lines per residential housing unit, which will allow for maintenance and spare pairs.

Pairs Per Business Location

This input is used in the calculation to determine distribution cable sizes. As noted in the model methodology guidelines, if the actual business line count per location is greater than this input, then the actual line count per location will be used. The utilization line per business unit represents the current engineering guideline minimum being used by CenturyLink for provisioning lines to business areas.

Maximum Size Feeder Distribution Interface

This input allows the user to enter the company's maximum size FDI normally deployed, as long as it does not exceed 7,200 pairs.

Maximum Fiber Size
This input allows the user to enter the company's maximum fiber size normally deployed, as long as it does not exceed 288 strands.

Maximum Feeder Size
This input allows the user to enter the company's maximum copper feeder cable size normally deployed, as long as it does not exceed 4,200 pairs

Maximum Distribution Size
This input allows the user to enter the company's maximum copper distribution cable size normally deployed, as long as it does not exceed the maximum copper cable size.

Innerduct Per Foot Cost Delta
This input is for the incremental cost per foot for innerduct placed inside a 4" standard conduit. Innerduct allows for easier fiber cable installation and better cable organization.

Number of Innerducts Per Duct
This input is the quantity of innerducts placed within a 4" conduit.

Fiber Route Sharing Ratio
This input is the ratio of sharing for fiber and copper when sharing a route. CenturyLink uses an equal sharing factor of 50%.

Concurrent Copper Feeder Cables
This input is the average number of concurrent copper feeder cables per feeder segment. The default CenturyLink input of "1" will build the optimal network. Any input greater than "1" may result in additional cables being built in the same segment.

Concurrent Fiber Feeder Cables
This input is the average number of concurrent fiber feeder cables per feeder segment. The default CenturyLink input of "1" will build the optimal network. Any input greater than "1" may result in additional cables being built in the same segment.

Concurrent Copper Distribution Cables
This input is the average number of concurrent copper distribution cables per segment. The default CenturyLink input of "1" will build the optimal network. Any input greater than "1" may result in additional cables being built in the same segment.

Concurrent Fiber Distribution Cables
This input is the average number of concurrent fiber distribution cables per segment. The default CenturyLink input of "1" will build the optimal network. Any

input greater than “1” may result in additional cables being built in the same segment.

Critical Water Depth
When the water table depth of the area is at or closer to the surface than the critical water depth, additional costs will be required to build the structure. Any placement of facilities in water-saturated area incurs additional cost either for the water placement or additional distance to place the cable around the water.

Water Factor
This input represents the percent of additional cost associated with the placement of facilities in or around the water occupied area.

Minimum Slope Trigger
Minimum slope is the LEAST amount of slope present in each geographical area. The minimum slope trigger is set at the point where slope causes facilities to be placed along the contours of the slope rather than in a point-to-point placement. This is one of three different slope triggers used within the model to adjust distance. The minimum slope trigger is set at an input in degrees. When this average is exceeded the distance is adjusted by the minimum slope factor (see below). For example, if the average terrain within a given area is equal to or less than the input in degrees, no additional adjustment for cable distance, and hence cost, is required.

The slope information is taken from the U.S. General Soil Map (STATSGO) produced by the United States Department of Agriculture’s Natural Resources Conservation Service[2].

Since more cable and structure are required when winding along contours of hillsides rather than cable placement in straight flat terrain, this input allows for the additional distance that facilities will require when traveling along this higher sloped terrain. This is comparable to building a road up a mountain. If a hill is too steep, then switchbacks are required which adds to the total distance traveled.

Minimum Slope Factor
Slope factors are the multipliers used to add the additional distance that the facilities must travel as they wind their way across the higher slope terrain. This factor comes in to play ONLY when the minimum slope trigger is exceeded, thereby, adjusting the cable distance using this minimum slope factor.

[2] STATSGO has been renamed to the U.S. General Soil Map. The U.S. General Soil Map consists of general soil association units. It was developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset published in 1994. It consists of a broad based inventory of soils and non-soil areas that occur in a repeatable pattern on the landscape and that can be cartographically shown at the scale mapped.

Since more cable is required when winding along contours of hillsides rather than cable placement in straight flat terrain, this input allows for the additional distance that facilities will require when traveling along this higher sloped terrain.

Maximum Slope Trigger

The maximum slope data shows that there are one or more points within the geographical area that may rise rapidly or peak while the area around this terrain may be flat or more gently sloped. The maximum slope trigger sets the degrees of slope at which facilities must be placed along the contours of the large slope with much greater variation in the direction than with the minimum slope terrain or in a point-to-point placement. The maximum slope trigger is set at an input in degrees. When this maximum is exceeded, the distance is adjusted by the maximum slope factor. For example, if the maximum terrain within a given grid is equal to or less than the input, no additional adjustment for cable distance above that which comes from the minimum slope adjustment is required. However, if the slope in that grid is greater than the input, then additional cost is required

Since significantly more cable is required when transversing steep slopes rather than cable placement in straight flat terrain, this input allows for the additional facility distance required.

Maximum Slope Factor

This value is the distance multiplier when maximum slope causes cables to be extended to “switchback” on a slope or go around sharply sloping areas. Since this tends to be a small area within the geographical grid, its impact on cost is generally less than an entire area sloping as happens with the minimum slope.

Since more cable is required when winding along sharply sloping contours, this input allows for the cost of the additional distance required.

Combination Slope Factor

This combination factor comes into play when both the minimum and maximum slope triggers are exceeded. The cable distance is adjusted by the combined slope factor. The combination of both triggers indicates that the terrain within the area has a major slope overall but also contains one or more rapid changes in even the general slope. This can best be described as severely undulating terrain with significant cost penalties when placing facilities. Often there is not any road access to the placement area, causing further increased costs.

DLC-Small Electronics Discount

This input is used in concert with the small DLC Investment inputs and represents any normal discounts that a company may receive. Since CenturyLink has applied its discounted material costs in the DLC inputs, this input is set at 100%.

DLC-Large Electronics Discount
This input is used in concert with the large DLC Investments and represents any normal discounts that a company may receive. Since CenturyLink has applied its discounted material costs in the DLC inputs, this input is set at 100%.

Fiber Cost Ratio
This input is used in concert with the fiber cable investment and represents any normal discounts that a company may receive. Since CenturyLink has applied its discounted material costs in the fiber inputs, this input is set at 100%.

Copper Cost Ratio
This input is used in concert with copper cable investment and represents any normal discounts that a company may receive. Since CenturyLink has applied its discounted material costs in the copper inputs, this input is set at 100%.

Redundant OC3 Optics
This input is used in to indicate if customer's with OC3 optical services require redundancy.

Copper Gauge
This input is used select the gauge of copper cable.

FOT System-to-Spare Ratio
This input reflects the number of Fiber Optic Terminal (FOT) systems that are sharing one set of spare cards.

Inches Per FOT Frame
This input indicates the number of usable inches per Fiber Optic Terminal Frame (FOT). Used to determine how many additional racks are need at the central office.

Number of Customer Fibers Per Location
This input indicates the number of fibers per customer SONET location.

DLC System-to-Spare Ratio
This input reflects the number of DLC terminals that are sharing one set of spare cards.

Electronic Fill
This input represents the amount of fill allowed to occur in DLCs and channel banks used to provide non-voice services. At the fill specified, CenturyLink begins planning for reinforcement.

HiCap Fill
This input represents the amount of fill allowed to occur in high capacity optical multiplexers. At the fill specified, CenturyLink begins planning for reinforcement.

Maximum Central Office Terminal DLC-Large
This input represents the largest Central Office Terminal that will be placed to serve one or more Large DLCs. After this point, an additional terminal would need to be added. This input is based upon the largest terminal capacity normally purchased.

Maximum Remote Terminal DLC-Large
This input represents the largest Remote Terminal that will be placed. After this point, an additional terminal would need to be added. This input is based upon the terminal capacity normally purchased.

Maximum Central Office Terminal DLC-Small
This input represents the largest Central Office Terminal that will be placed to serve one or more Small DLCs. After this point, the model will switch to a large terminal.

Maximum Remote Terminal DLC-Small
This input represents the largest small DLC that will be placed. After this point, the model will switch to a large terminal.

CLLI Length
This input reflects the standard alphanumeric 11-character value for the wire center Common Language Location Identifier (CLLI) code.

CO Install Labor Rate
This input is the state-specific hourly rate for Central Office installation labor.

OSP Install Labor Rate
This input is the state-specific hourly rate for Outside Plant installation labor.

Engineering Labor Rate
This input is the state-specific hourly labor rate for Engineering.

Buried Drop Install 150
This input is the labor cost to place the first 150 feet of buried drop.

Per Ft. Buried Drop Adder
This input is the cost per foot adder for installation of buried drop lengths over 150 feet.

Aerial Install Hours
This input is the number of labor hours required to install aerial drop.

DrpAdditive

This input represents the number of feet of drop or drop cable that extends beyond the minimum premises setback distance.

DrpCblAdditive
This input represents the number of feet of drop cable to an indoor FDI required inside the customer premises.

Miscellaneous Tables

The tables found within this tab contain data relating to the sizing of SONET systems and DLC cabinets, capacity and configuration of DS1 channel banks within the DLC cabinet, labor hours for installs, and the pair and bandwidth requirements for each of the circuit types.

Services Configuration Table
This table shows cable pairs, drop pairs and termination costs, per unit, by service type.

System Indicator Table
This table lists indicator reference numbers for various optical service types within the SONET system.

SONET Frame Table
This table lists frame inches, per system, for optical services within the SONET system. This allows for efficient use of racking for shelves.

Plugin Bandwidth Table
These inputs identify the DS-0 equivalents of various services. Voice grade equals one DS-0, while a DS-1 is equivalent to 24 DS-0s. Inputs are populated for 4-wire, DS-0, DS-1, and ISDN-BRI. This input is used in calculating the bandwidth required to serve a DLC that provides these services.

Fiber Electronics Table
This input table defines SONET system requirements for providing DS-3 service to customers. The least cost, most efficient system is used to provide various numbers of DS-3s. The optimal number of fibers is used to determine how many fibers will be utilized to provide the DS-3 service. Any excess fiber capacity to those customers that is not used in providing other services is classified as dark fiber.

Factor Table
This table indicates the state-specific sales tax, the power factor to account for recovery of backup power at the central office, and the concentration ratio applied to unbundled element platforms.

Labor Hours Table
This table documents number of engineering and installation hours required, by equipment type.

DS-1 Pointer Table
Based upon the quantity of DS-1s, the table indicates which column should be referenced in the DS-1 Cabinet Lookup Table to determine appropriate DS-1 cabinet/shelf size.

Cabinet Lookup Table
This table designates appropriate cabinet size/type, according to voice grade lines and DS-1 quantities.

Fixed Tables

The tables within this tab contain tables that relate: 1) The many soil types to a placement difficulty indicator (0 is normal and 1 is difficult); 2) The density to a reference column for lookups in other tables; and 3) Central office information to the wirecenter reference number. Values in these tables are set in the input phase of the process and are pulled from the comparable tables in the input module.

Surface Texture Table
This table documents all varieties of surface textures, as defined by the U.S. General Soil Map (STATSGO), and the impact of each particular terrain type.

Wire Center CLLI Table
This table contains CenturyLink data on CLLI code, wire center name, and primary NPA-NXX of wire center.

Density Pointer Table
This table contains the set of columns denoting density level inputs. This table provides column pointers for look up formulas.

Surface Condition Table
This table contains the numeric value of the condition of the surface denoted by the surface texture and rock hardness.

Summary Fiber Tables

This tab contains tables that summarize the cost of fiber by plant type and cable size. The values within the tables on this table are used within LM to calculate investments.

Summary Cable Tables

This tab contains tables that summarize the cost of copper cable by plant type, cable gauge and cable size. The values within the tables on this table are used within LM to calculate investments.

Summary Other Cost Tables

This tab contains tables that summarize the cost for any given plant unit by size and by density. Sizing and costs are included for items such as fiber and copper cable, drop terminals, drops, NIDs, and indoor and outdoor FDIs. The values within the tables on this tab are used within LM to calculate investments.

Summary Structure Tables

The tables on this tab summarize the inputs for structure. The values within the tables on this tab are used within LM to calculate investments.

Appendix – Master Price List

The Master Price List includes all necessary equipment to build digital loop carriers, channel banks for non-voice services, and high capacity SONET terminals.

Digital Loop Carrier

The Digital Loop Carrier (DLC) is network transmission equipment that is used to reduce the number of copper feeder pairs or cables needed to activate the necessary distribution pairs. It multiplexes multiple voice grade channels onto one fiber facility to the central office. The cost of a DLC is broken down into three components:

- DLC Central Office Terminal (COT) Investment
- Fixed DLC Remote Terminal (RT) investment
- Variable Digital Loop Carrier Remote System investment (cards)

The size of the DLC will depend on access line demand within the Carrier Serving Area (CSA) and the user defined utilization rate. For example, if there are 90 POTS lines within a CSA and the utilization rate is 75%, then CenturyLink will place a remote terminal capable of serving 120 lines with the appropriate number of line cards and shelving.

The DLC COT looks much like other central office equipment, being comprised of relay racks. Each shelf will hold various card types. A COT DLC is pictured below.

DLC Central Office Terminal

The Remote Terminal DLC is an environmentally controlled, aluminum and steel enclosure. The outdoor cabinet can be configured for purely copper, fiber, or a combination of both. A typical DLC Remote Terminal is pictured below:

Outside view of the DLC Remote Terminal

The main cabinet houses three compartments, an equipment compartment, splice compartment, and a copper protection and fiber compartment.

Front inside view of the DLC Remote Terminal

The front equipment compartment contains the service shelves, a rectifier shelf, and a remote testing unit. The compartment also contains the AC load center and the DC distribution box.

Side view of the DLC Remote Terminal

The side splice compartment contains subscriber cable entry holes, an AC cable entry hole, and two peg boards for mounting all splice equipment and fiber distribution options.

Rear inside view of the DLC Remote Terminal

The rear compartment houses the copper protection panels. The panels are hinged to support easy maintenance and access to the backs of the service shelves. Each protection block provides protection for two copper plug-in cards.

Protection blocks terminate with MS2 connectors for interface in the splice compartment.

Material investment for DLC systems includes the central office and remote common equipment and cards. State specific sales tax was added to the material cost. Labor costs for the DLCs include the engineering, outside plant technician, and central office technician labor necessary to install and test the equipment. Another remote terminal cost component is site preparation. Site preparation includes installation of a concrete pad and any landscaping or protection required by local ordinances.

DLC Configuration

Remote terminal configurations will depend on several variables including access line and high capacity special access demand within the CSA. In small CSAs with little or no high capacity demand, the remote terminal configuration will consist of a remote terminal cabinet that contains a primary shelf and, if demand warrants, a secondary shelf.

In larger CSAs, or CSAs with numerous high capacity special access facilities, a remote terminal cabinet can consist of a DLC terminal, a fiber optic terminal (FOT) and a channel bank. The channel bank is used to terminate end user DS-1s so shelf capacity on the DLC can be more effectively used for voice grade services. In this configuration, both the DLC terminal and the channel bank can interface with the FOT terminal at the DS-3 level.

DLC central office investment includes material and labor costs for installing central office DLC equipment. Additional investment is required for larger systems that also require OC-n fiber optic terminals.

DLCs systems have been modeled to provide a least cost forward-looking unbundled loop. Using advanced provisioning methodology, loops can be provisioned between the local exchange terminals (LET) to the DLC. This provisioning methodology will assign loops that are cross-connected at the ILEC Main Distribution Frame (MDF) to the CLEC collocation. The provisioning methodology provides flexibility and allows the ILECs to provide unbundled loops to CLECs by providing the ability to break out or hand off an individual voice or data circuit coming from the DLC-RT to a CLEC at the central office.

OCn Fiber Optic Central Office Terminal equipment is installed with the central office terminal and is required to provide the optical capacity from the COT to the RT. This equipment sends and receives the optical light signals on the central office end of the DLC system fibers.

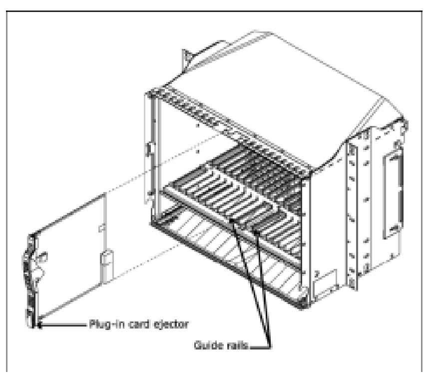
Digital Loop Carrier Remote System Fixed Cost includes material and labor for the remote DLC terminal that is equipped with an OCn Fiber Optic Terminal, the DLC cabinet, equipment shelves, batteries, cable termination blocks, and concrete mounting pad. `

The OCn fiber optic equipment is the remote end of the system. This equipment is located at the DLC cabinet and is used to provide OCn fiber capacity from the COT to the RT. This equipment sends and receives the optical light signals on the subscriber end of the DLC system fibers. It performs the optical/digital signal conversion.

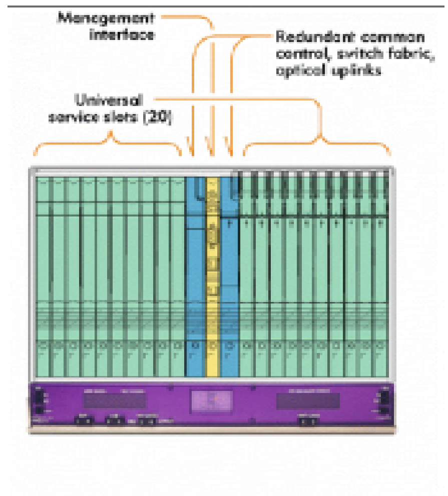
The DLC cabinet is an environmentally hardened enclosure that houses the field end DLC terminal electronics and batteries. It is generally located in easements on a concrete pad. The site preparation is part of the DLC cabinet cost and is based upon CenturyLink-specific costs and local zoning ordinances.

Batteries are for emergency power backup in the event of a commercial power outage. A charger installed in the DLC cabinet recharges the batteries.

DLC Line Cards are plug-in printed circuit boards that provide either analog voice grade or digital data interfaces for private or public network use. Although there are various card types listed in the input tables, only the voice grade or POTS card is used in calculating the cost of a POTS loop. Other service type cards are used in calculating ISDN-BRI, DS-1, and DS-0 loop costs.



View of the DLC Card Slots



DLC Card Slots per Shelf

For loops served via DLC, different pieces of equipment are required to provide various services. The inputs and calculations in LM reflect that different equipment is required for different services. For voice grade loops, common equipment is determined and is allocated by capacity. For example, if a DLC RT serves 672 lines, each of those 672 lines would incur 1/672 of the common equipment cost. Likewise, DS-1s will use a portion of the common equipment and have separate equipment (i.e. channel bank) needed to provide those services. For equipment common to all services, the allocation is based on space capacity. For the equipment used only for DS-1s, the capacity of the equipment is spread over the DS-1s in the system. Optical equipment is allocated based on bandwidth requirements. For example, a DS-1 will require 24 DS-0s worth of bandwidth, ISDN-BRI will require 3 DS-0s, and a voice grade loop requires only 1 DS-0. By calculating inputs and investment in this manner, each service is allocated its share of the DLC equipment and allocated its share of the feeder facility.

The Master Price List is used by both the LM and the Transport Cost model. The components of the electronics equipment modeled in LM are defined below.

Remote Terminal Costs - Fixed

a) Remote Cabinet Costs - DLC remote cabinet costs include the cabinet, 12 position fiber splicing tray, mounting hardware, battery compartment base, fan tray, fan tray filter, 5-PIN protectors, pour in place template, backup batteries and site prep. Larger cabinets also include fiber distribution panel, 84 circuit DSX-1 panel, DS-1 connecting cable, power harness and jumpers. Cabinet costs vary by size and are equipped with primary and secondary shelves. The number of secondary shelves varies by cabinet size.

b) DLC Card - Fixed card costs which contain the system switch matrix, real-time processor and memory, and timing source. The card contains one optical interface to be used as the network interface.

c) Administration and Maintenance Processor Card (AMP) – The AMP card hosts system administrative software and provides the access point for craft and element management systems. It also contains test access and contact closure alarms and controls.

d) Adtran TA3000 Channel Bank - Fixed costs for the Adtran unit includes the Total Access© shelf, dual BNC adapter and enhanced system controller unit (SCU).

e) Adtran TA3000 Card Costs - Fixed costs consist of a DS-3 ATM MUX. An OC-3 MUX can be used in lieu of the DS-3 MUX when three units are linked or when a SONET interface is required.

Central Office Terminal - Fixed

a) Central Office Terminal (COT) Costs - Fixed COT costs include the COT frame, primary shelf, fan tray, fan filter, and secondary shelf when required.

b) Adtran TA3000 Channel Bank - Fixed costs for the Adtran unit includes the Total Access© shelf, dual BNC adapter and enhanced system controller unit (SCU).

c) Adtran TA3000 Card Costs - Fixed costs consist of a DS-3 ATM MUX. An OC-3 MUX can be used in lieu of the DS-3 MUX when three units are linked or when a SONET interface is required.

DLC Line Cards

The following cards can be used with the central office or remote terminal on an incremental basis:

a) DS-0-DP - The Digital Signal Zero Data Port (DS0-DP) card provides full duplex, synchronous data interface at 64kbps with 6 interfaces per card. The DS-0-DP card can be plugged into any of the 20 universal slots on a shelf.

b) RU2W-24 - The RU2W-24 plug-in card provides 24 two-wire, analog interfaces. The first four interfaces are for Coin service and each interface supports POTS, UVG, or 2WTO. The RU2W-24 card can be plugged into any of the 20 universal slots on a shelf.

c) RPOTS-24 – The RPOTS card, used in the remote DLCs, provides 24 two-wire analog interfaces which can be configured for POTS. The RPOTS-24 card can be plugged into any of the 20 universal slots on a shelf.

d) HPOTS-24 – The HPOTS card, used in the central office, provides 24 two-wire analog interfaces which can be configured for POTS with a switch interface. The HPOTS-24 card can be plugged into any of the 20 universal slots on a shelf.

FOT Cards

a) DS-1 Floating Drop Interface (DMI102) - The DMI102 card provides interface between low speed (1.e. DS-1) traffic and STS-1 bus.

b) DS1WW 202 DS1 Wire Wrap Panel - The DS1WW serves as interconnection input/output panel for terminating the tip and ring wires of DS-1 ABAM cable using wire wrap pins.

c) Virtual Group Interface (VTG102) - The VTG102 is a low speed interface between the DS-1 facility and the DMI102. The VTG102 can support up to four DS-1 signals to a VT group bus on the DMI unit.

d) Quad DS-3/STS-1 Interface (LIF502) - The LIF502 provides a quad DS3 or STS1 I/O low speed interface between the VT/STS-1 cross-connect matrix (CCM) plug-in unit and the LDR plug-in unit. Each of the 4 circuits on the LIF 502 can be provisioned independently as either DS-3 or STS-1.

e) HD 12 DS-3/STS-1 Interface (LIFD01) - The LIFD01 provides 12 DS-3 or STS-1 low speed interfaces between the CCM plug-in unit and the LDR plug-in unit. The I/O circuits on the LIFD01 can be provisioned as either DS-3 or STS-1.

f) LDR101 Line Driver/Receiver - provides the facility interface between l9ow speed interface (LIF) plug-in units and the coaxial I/O panel (CIOP20x) that mounts on the rear of the shelf assembly. The LDR101 can support either DSX-3 or STSX-1 facilities.

g) LDR501 Dual Line Driver/Receiver - the LDR501 provides the facility interface between the DS3/STS1 low speed interface (LIFD01) plug-in unit and the CIOP 401/501.

h) Coaxial Input/Output Panel (CIOP401) - the CIOP401 serves as an interconnection I/O panel for terminating either DS-3 or STS-1 external cabling. It provides the electrical and physical interface between the DSX-3 or STSX-1 cross connects and the LDR plug-in unit.

i) Fiber Expansion Panel (FES201) - The FES201 provides patch panel capabilities for up to 32 fiber optic cables. This allows use of up to four LIFF01 plug-in units in the SMX shelf drop groups.

j) OC-3 Low Speed Interface (LIF404) - The LIF404 is an intermediate reach low speed optical interface. LIF404 units are equipped with front panel mounted FC/PC optic connectors. The SMX can accommodate up to two LIF404plug-in units for each of the 4-drop groups.

k) Low Speed Quad OC-3 Interface (LIFF01) - the LIFF01 is an intermediate reach low speed optical interface equipped with front panel mounted LC optic connectors. The SMX shelf can accommodate up to two LIFF01 plug-in units for each of the 4-drop groups.

l) Low Speed OC-12 Optical Interface (LIFA01) - The LIFA01 is an intermediate reach low speed optical interface. LIFA01 units are equipped with front panel mounted FC/PC optic connectors. The SMX can accommodate up to two LIFA01 plug-in units for each of the 4-drop groups.

m) High Speed OC-3 Optical Interface (HIFB01) - the HIFB01 plug-in units provide the optical interface between the customer's fiber transmission link and the SMX's cross connect/drop module. The HIFB01 has built in fiber optic transmitter and receiver assemblies that operate at the OC-3 line rate. The SMX shelf can accommodate up to two HIFB01 plug-in units for each of the two line groups.

n) High Speed OC-12 Optical Interface (HIFA01) - the HIFA01 plug-in units provide the optical interface between the customer's fiber transmission link and the SMX's cross connect/drop module. The HIFA01 has built in fiber optic transmitter and receiver assemblies that operate at the OC-12 line rate. The SMX shelf can accommodate up to two HIFA01 plug-in units for each of the two line groups.

o) High Speed OC-48 Optical Interface (HIFF01) - the HIFA01 plug-in units provide the optical interface between the customer's fiber transmission link and the SMX's cross connect/drop module. The HIFF01 has built in fiber optic transmitter and receiver assemblies that operate at the OC-48 line rate. The SMX shelf can accommodate up to two HIFF01 plug-in units for each of the two line groups.